

**Section 1: Direct and Partial Variation**

Constant of variation =

$$\frac{\Delta \text{dependent}}{\Delta \text{independent}}$$

1. Find the constant of variation for each direct variation.

- a) The cost for a long-distance telephone call varies directly with time. A 12-min phone call cost \$0.96.

$$m = \frac{\$0.96}{12 \text{ min}} = 0.08 \text{ \$/min}$$

- b) The total mass of magazines varies directly with the number of magazines. The mass of 8 magazines is 3.6 kg.

$$m = \frac{3.6 \text{ kg}}{8 \text{ magazines}} = 0.45 \text{ kg/magazine}$$

- c) The distance travelled varies directly with time. In 3 h, Alex drove 195 km.

$$m = \frac{195 \text{ km}}{3 \text{ h}} = 65 \text{ km/h}$$

2. The Jung family travels 300 km to a relative's home. The distance,  $d$ , in kilometres, varies directly with the time,  $t$ , in hours.

Equation of a direct variation is:

$$y = mx$$

- a) Find an equation relating  $d$  and  $t$  if  $d = 144$  when  $t = 1.5$ . What does the constant of variation represent?

$$m = \frac{\Delta d}{\Delta t} = \frac{144}{1.5} = 96 \text{ km/h} \quad \left( \begin{array}{l} \text{the constant of variation represents} \\ \text{the average speed.} \end{array} \right)$$

$$d = 96t$$

- b) Use the equation to determine how long it will take the Jungs to reach their destination.

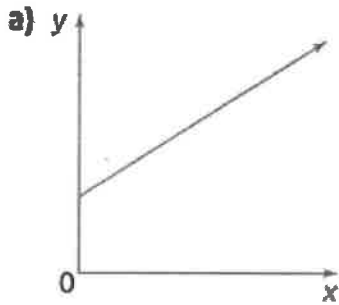
$$300 = 96t$$

$$\frac{300}{96} = t$$

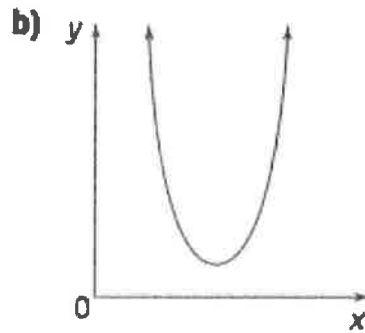
$$t = 3.1$$

It will take 3.1 hours.

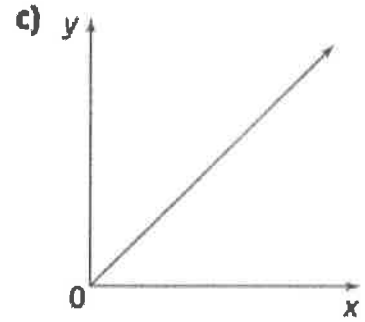
3. Classify each of the following graphs as direct variation, partial variation, or neither.



Partial



Neither



Direct

4. The following table shows the Cost,  $C$ , to park in a downtown parking lot based on the number of hours,  $t$ , your car is parked for.

$t$ (h)	$C$ (\$)
0	0
0.5	1.50
1	3.00
1.5	4.50
2	6.00
2.5	7.50

a) Is this an example of direct or partial variation?

Direct

b) What is the constant of variation?

$$m = \frac{\Delta y}{\Delta x} = \frac{3}{1} = 3$$

c) What does the constant of variation represent in this situation?

This represents the cost per hour to park downtown.

d) Write an equation relating  $C$  and  $t$

$$C = 3t$$

5. For the following table of values:

x	y
0	10
1	14
2	18
3	22
4	26

a) Is this an example of direct or partial variation?

Partial

b) What is the initial value?

$$b = 10$$

c) What is an equation for this relation in the form

$$m = \frac{\Delta y}{\Delta x} = \frac{14 - 10}{1 - 0} = \frac{4}{1} = 4$$

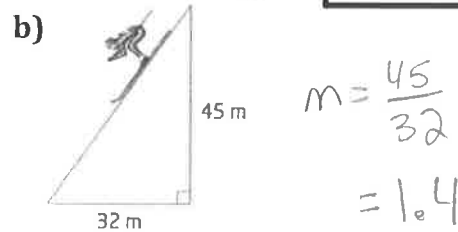
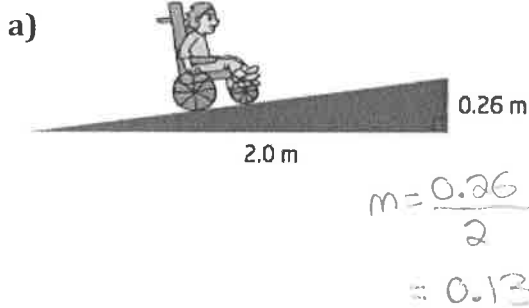
$$y = 4x + 10$$

Equation of a partial variation:

$$y = mx + b$$

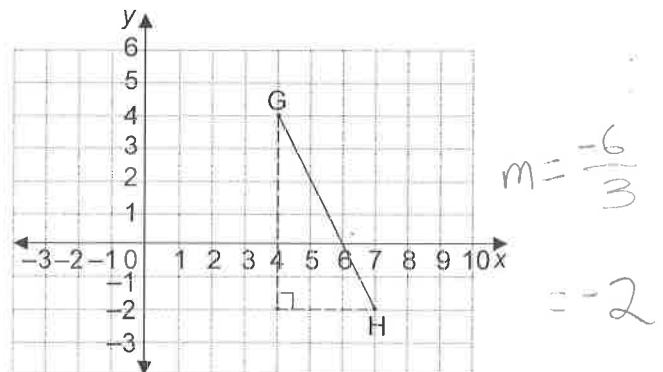
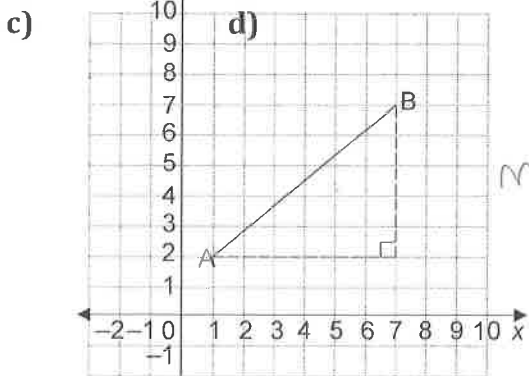
## Section 2: Finding Slope from a Graph

6. Find the slope of each object/line:

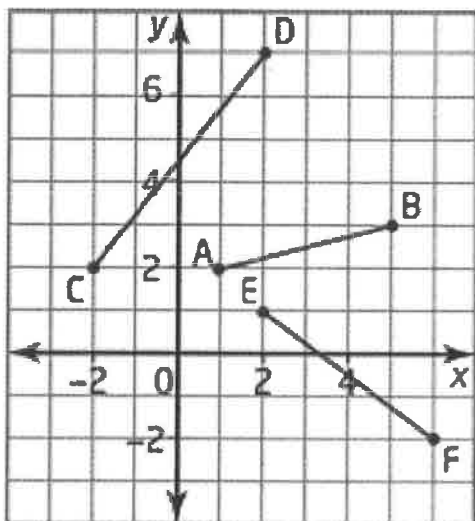


Remember:

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$



7. Find the slope of each of the following lines



Slope of AB:  $\frac{1}{4}$

Slope of CD:  $\frac{5}{4}$

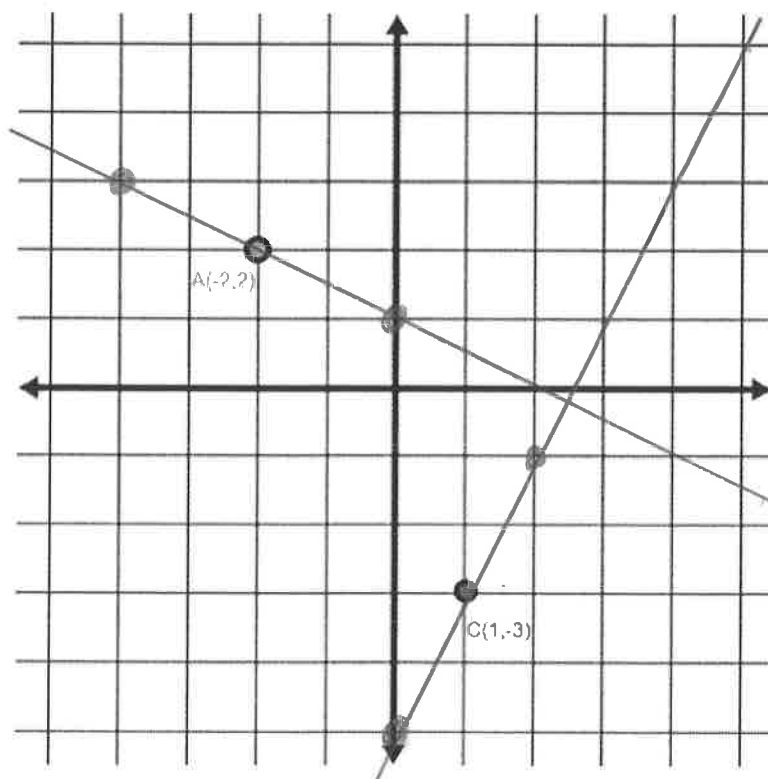
Slope of EF:  $-\frac{3}{4}$

8.

a) Point A(-2,2) is plotted on the grid below. Draw line segment AB that has a slope of  $-\frac{1}{2}$ . Complete the table on the left with the coordinates of a point to the left and right of A.

b) Point C(1,-3) is plotted on the grid below. Draw line segment CD that has a slope of 2. Complete the table on the right with the coordinates of a point to the left and right of C.

x	y
-4	3
-2	2
0	1



x	y
0	-5
1	-3
2	-1

### Section 3: Slope as a Rate of Change

$$\text{Rate of change} = \text{slope} = \frac{\Delta \text{dependent}}{\Delta \text{independent}}$$

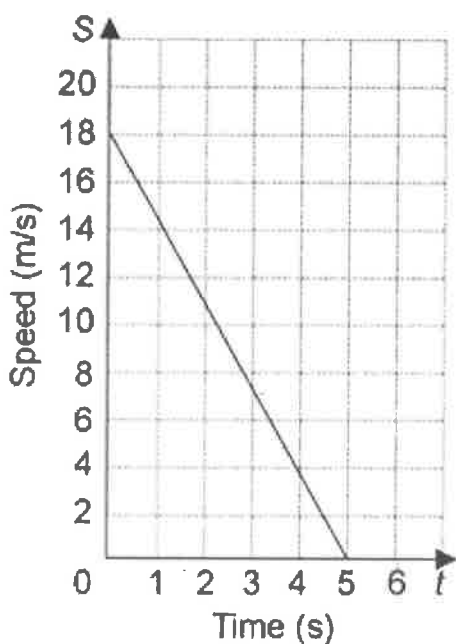
9. At rest, Vicky takes 62 breaths every 5 min. What is Vicky's rate of change of number of breaths?

$$m = \frac{\Delta y}{\Delta x} = \frac{62 \text{ breaths}}{5 \text{ minutes}} = 12.4 \text{ breaths/min}$$

10. When he is sleeping, Jeffrey's heart beats 768 times in 12 min. What is his rate of change of number of heartbeats?

$$m = \frac{\Delta y}{\Delta x} = \frac{768 \text{ beats}}{12 \text{ minutes}} = 64 \text{ beats/min}$$

11. The graph shows the speed of the cars on a roller coaster once the brakes are applied.



$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

a) Find the slope of the graph

$$m = \frac{-18}{5} \\ = -3.6 \text{ m/s}^2$$

b) Interpret the slope as a rate of change

This represents the acceleration of the roller coaster cars.

For every 1 second, the cars reduce their speed by 3.6 m/s.

## Section 4: First Differences

12. Use first differences to determine if each relation is linear or non-linear

a)

$t$	$d$
-1	21
0	13
1	9
2	7
3	6

-8  
-4  
-2  
-1

non-linear

b)

$x$	$y$
0	4
1	11
2	18
3	25
4	32

7  
7  
7  
7

linear

## Section 6: Writing Linear Equations

13. For the following table of values:

a) Calculate the slope (constant of variation)

$$m = \frac{\Delta y}{\Delta x} = \frac{5-2}{1-0} = \frac{3}{1} = 3$$

b) What is the y-intercept (initial value)

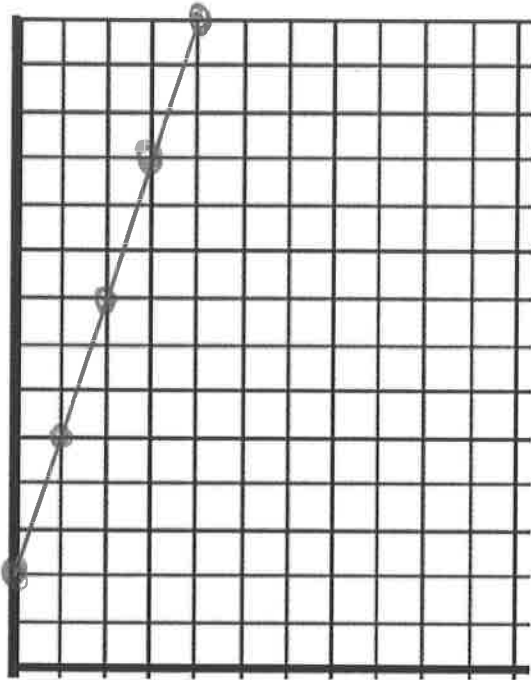
$$b = 2$$

c) Write the equation of the linear relation

$$y = 3x + 2$$

$x$	$y$
0	2
1	5
2	8
3	11
4	14

d) Graph the relation

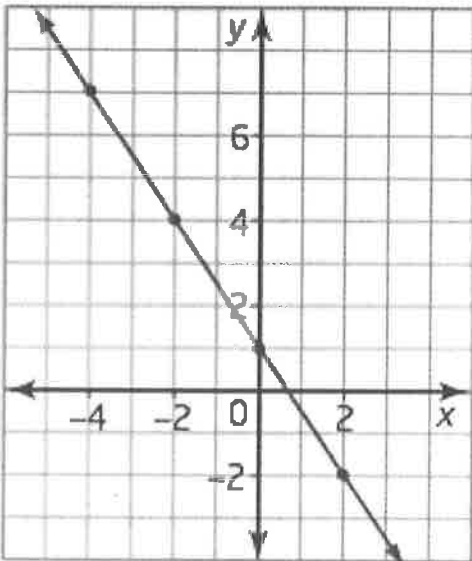


$$y = 3x + 2$$

initial value

$$m = \frac{3}{1} \begin{matrix} \leftarrow \text{rise} \\ \leftarrow \text{run} \end{matrix}$$

14. For the following linear relation:



a) Calculate the slope

$$m = \frac{\text{rise}}{\text{run}} \\ = \frac{-3}{2}$$

b) What is the y-intercept?

$$b = 1$$

c) Write an equation for the line

$$y = \frac{-3}{2}x + 1$$

15.  $y$  varies directly with  $x$ . When  $x=3, y=5$

a) What is the slope of the line

$$m = \frac{\Delta y}{\Delta x} = \frac{5-0}{3-0} = \frac{5}{3}$$

b) What is the  $y$ -intercept (hint: what is the  $y$ -intercept of all direct variation relationships?)

$$b = 0$$

c) Write an equation for the line

$$y = \frac{5}{3}x$$

16.  $y$  varies partially with  $x$ . When  $x = 0, y=1$ , and when  $x = 2, y=7$ .

a) What is the slope of the line?

$$m = \frac{\Delta y}{\Delta x} = \frac{7-1}{2-0} = \frac{6}{2} = 3$$

$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$
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b) What is the  $y$ -intercept (what is the  $y$ -value when  $x=0$ ?)

$$b = 1$$

c) Write an equation for the line

$$y = 3x + 1$$

17. A class is planning a field trip to an art gallery. The cost of renting a bus is \$250. There is an additional fee of \$4 per student. Write an equation to represent this linear relationship.

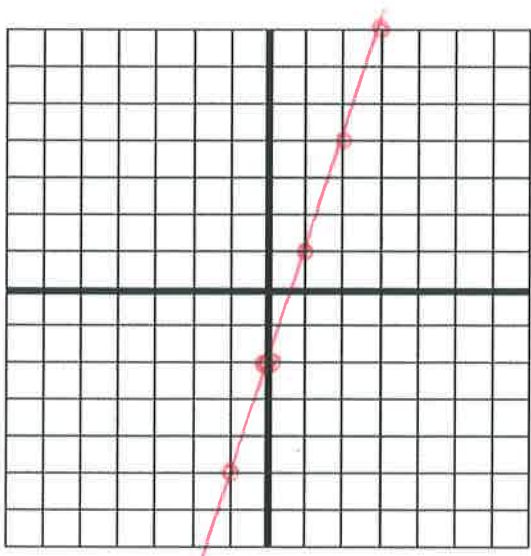
$$y = 4x + 250$$



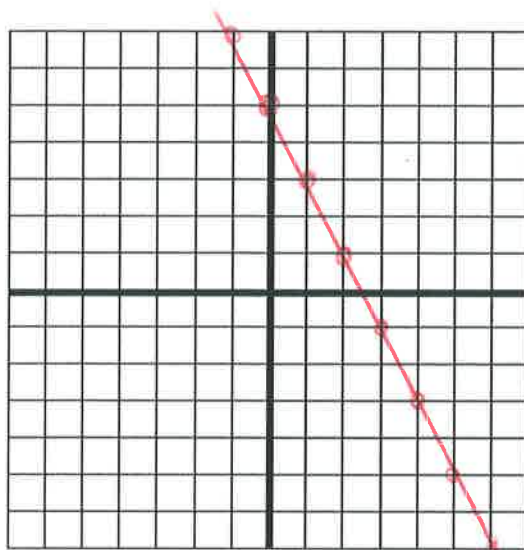
## Section 6: Graphing a Linear Relation

18. Graph each of the following lines on the grids provided.

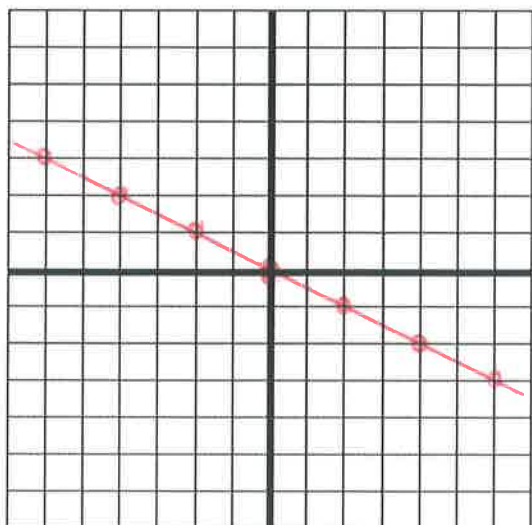
a)  $y = 3x - 2$



b)  $y = -2x + 5$



c)  $y = -\frac{1}{2}x$



d)  $y = \frac{3}{2}x - 3$

